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Letters to the Editor

Angular distributions of K shell photoelectrons

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Of all the theories on the K-shell photoelectric effect Nagel's (1960) theory is the first one, which gives satisfactory results at all the energies and in all the elements. The results of theories later developed (Pratt 1964 ; Rakavy & Ron 1967 ; Schmickley & Pratt 1967) are found to be in satisfactory agreement with that of Nagel (1960). In the present investigations a study of the angular distributions of K-shell photoelectric cross-sections based on Nagel's (1960) theory with energy and atomic number is made.

The study of angular distributions of photoelectric cross-sections is rather interesting as the intensity of photoelectrons varies with angle and energy. Hultberg *et al* (1961) made numerical calculations utilising the expressions of Nagel (1960) at 662, 412, 279, 208 and 140 keV in U, verified experimentally at 662 keV and found a satisfactory agreement within the limits of the experimental accuracy and difficulty. Measurements of Sujkowiskis' (1961) and Bergkvist *et al* (1965) on the angular distribution

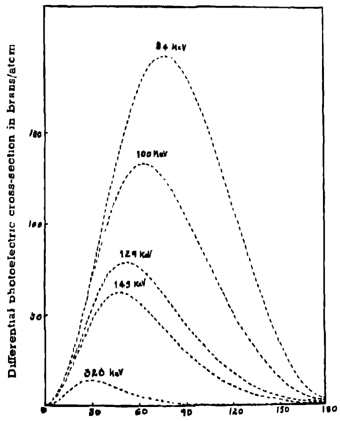

Figure 1. Plot between photoelectric cross-sections Vs angle at various gamma energies in tantalum.

are found to be in agreement with Nagel's (1960) calculations at 279 and 412 keV gamma energies. In view of these agreements with the experimental results systematic theoretical studies are made on the angular distributions of K-shell photoelectrons in Pb, Pt, Ta, Sn, Rh and Cu at gamma energies 84, 100, 129, 145 and 320 keV. The necessary calculations utilising Nagel's (1960) expressions are made on computer.

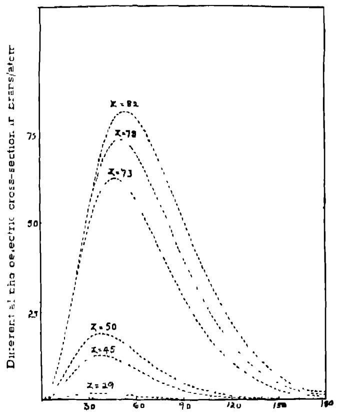

Figure 2. Plot between photoelectric cross-section vs angle in various elements at gamma energy 145 keV.

In figures 1 and 2 typical distributions with energy and atomic number are shown. It can be seen from these figures that photoelectrons will be emitted from 0° to 180°. As the angle increases the intensity increases, reaches a maximum and decreases gradually. The intensity also increases as the gamma energy decreases and as the atomic number increases. In table 1 the angle at which the intensity of the K-shell photoelectrons is maximum for each element at each energy is given. It can be seen from the table that the angle of maximum intensity emission increases as the atomic number increases and gamma energy decreases.

TABLE 1. ANGLE OF MAXIMUM PHOTOELECTRON EMISSION (IN DEGREES)

Energy keV	Pb	Pt	Ta	Sn	Rh	Cn
84	...	...	77	. .	48	...
100	...	73	63	...	45	...
129	62	56	51	...	39	...
145	54	51	48	39	...	34
320	31	29	28	26	...	24

It is hoped that these findings are useful for experimental verification, especially at low gamma energies, where no experimental data are available.

The authors are thankful to Dr. S. Hultberg for kindly arranging the computations of differential K-shell photoelectric cross-sections at Sweden, and also to the Swedish Government for sparing free machine time.

References

Bergkvist, K. & Hultberg, S. 1965 *Arkiv For Fysik*, **27**, 326.

Hultberg, S., Nagel, B & P. Olsson, 1961 *Arkiv For Fysik*, **20**, 555.

Nagel, C. H. 1960 *Arkiv For Fysik*, **18**, 1.

Pratt, R. H. Levee, R D. Pexton, R. H. & Aron W. *Phys. Rev.*, **134A**, 898.

Rakavy, G. & Ron, A. 1967 *Phys. Rev.*, **159**, 50.

Schmickley, R. D. & Pratt, R H 1967 *Phys. Rev.*, **163**, 104.

Sujkowiski, Z. 1961 *Arkiv For Fysik*, **20**, 269.

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A furnace with uniform temperature region for a horizontal X-ray diffractometer

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In this paper a simple diffractometer furnace assembly is described which can be built from materials available in ordinary laboratories. The sample holder can be detached at will. The heater can also be removed with the sample holder in position. Complete range of 2θ angles (0° to 180°) can be investigated. The furnace, using nichrome wire, is used upto 800°C but with Pt-10% Rh winding the range can be extended to 1200°C. The furnace assembly is designed to fit the horizontal diffractometer made by Rich. Seifert, Germany.

The heater is shown in figure 1. A porous pot used in Daniel Cells was cut from both sided so as to obtain a cylinder of about 8.5 cm. in length and 5 cm. in diameter. A slot was cut along its length, as shown in the figure, for X-rays to enter and leave. The heating element consists of nichrome wire of S. W. G. 26. The element is in the coiled coil form inside the furnace and straight outside. The distance between two consecutive coils and the pitch of the coil were so adjusted, especially near the slot as to obtain a region of as uniform a temperature inside the furnace as possible.